EPA's ORD Research Program on Alternative Textile Care Technologies: Part I

Charles Riggs

Texas Woman's University

Dr. Riggs is a professor at Texas Woman's University (TWU) in the Department of Fashion and Textiles. He has been involved in research, teaching, and professional service to the laundry and dry cleaning industry for more than 20 years. In addition to teaching and research duties at TWU, he serves as Director of the Texas Research Center for Laundry and Dry Cleaning. The Center was founded in 1983 as a cooperative effort between TWU and the Southwest Dry Cleaning Management Institute. Dr. Riggs holds a Ph.D. in Chemistry.

I wanted to give you a little bit of history. The Research Center for Laundry and Dry Cleaning at Texas Woman's University (TWU) was founded in 1983 with the sole purpose of providing a center in Texas for research and training in laundry and dry cleaning. The Texas Laundry and Dry Cleaning Association uses the center as a training facility. The association worked with the manufacturers of professional cleaning equipment to provide the university with the equipment. In 1983, it amounted to about a half million dollars of donated equipment to put the center together. Since that time, there has been some evolution of the equipment and some replacement; we are trying to keep it up to date. This project will probably bring us to the cutting edge of technology at the center. TWU also runs the center as a production plant where we service the uniforms on campus and do over-the-counter work. The project will, indeed, give us access to typical customer items, and we can collect data in that form.

TWU has very active participation with industry, and I wanted to give credit to our partners within the industry who have long supported our research programs at TWU. We have worked with the Southwest Drycleaners Association, the Textile Rental Service Association of America, and the Uniform and Textile Services Association of America. For the project we're speaking about today, we are in partnership with North Carolina State University (NCSU). The two universities jointly responded to a request for proposals for Testing and Development of Pollution Prevention Alternatives to Reduce Indoor Air Emissions from Perchloroethylene Dry Cleaning and Dry Cleaned Fabrics from the U.S. Environmental Protection Agency (EPA) and we were successful in receiving the funding. It was mentioned earlier that I would speak about results, but results are not yet completed. In fact, the project is just beginning, so, rather than talk about results, Dr. Perry Grady and I will talk about our intentions. I think the timing is excellent because this gives us a chance to respond to your concerns and input as to what directions we should follow with the project. NCSU, with its engineering capability, will identify and screen new technology, and, in many cases, build equipment to evaluate how well it will clean and perform. At TWU, with our operating plant, we will be looking at technology currently available to the industry. Then together, we intend to develop a protocol that would be universally acceptable to evaluate cleaning technology. Certainly our intention is to learn from the European research organizations and not try to deviate from what's being done in Europe. In fact, one of our students has just returned from 2 weeks at the Hohenstein Institute, learning the European protocol for wet cleaning assessment, which we will try to adapt as closely as possible in our trial efforts.

Dry Cleaning Technology

Perchloroethylene (perc) is indeed the most commonly used solvent. There's also solvent cleaning with hydrocarbons, and both hand and machine wet cleaning. What we're talking about here today is more machine wet cleaning and the distinction is more of a production technique. At this point companies have already contributed to help support this project with EPA. We have the wet cleaning machine from UNIMAC in place and running and a drying cabinet from Aquatex (a central part of the wet cleaning procedure is to be able to dry without agitation). Boewe-Passat, Permac division is sending two machines, a perc machine and a hydrocarbon dry cleaning machine. We will be using the Exxon synthetic hydrocarbon solvent DF2000. Our assessment is that this solvent would provide the most reproducible results since distilled hydrocarbons vary somewhat in composition from one

manufacturer and one distiller to another. We are still optimistic that we can actually evaluate the carbon dioxide technology. It's not currently available to the industry, but projections are that it will be available in the near future. So, if we have a machine available which is characteristic of what will be sold to the industry, then we will also include that technology in our assessment.

I wanted to review some of the basic concepts so you would appreciate some limitations of the project. In typical solvent cleaning, the process is one of cleaning, filtering, distilling, and reusing the solvent within the cleaning plant. So, this industry is indeed one that is a recycling industry and always has been. Solvents are most effective on oily type soils. In fact, very little additive is necessary to remove oily soils from fabrics, but it's quite difficult to remove water-soluble soils such as perspiration, salt, and sugar. Some fibers are sensitive to solvents, and some dyes and finishes are removed by solvents. As has already been stated, perchloroethylene has the advantage of not being flammable, but it has health and environmental concerns; whereas, hydrocarbons are flammable, and they may also pose some long-term health and environmental concerns. For wet cleaning, we want to distinguish that this is not laundering; this is not a technique that would be practiced at home. It would require the care and training of a professional. In the case of wet cleaning, the water is discharged to the sewer so there may be some environmental consequences to consider. Wet cleaning is most effective on water-soluble soils, and the problem soils are oil-based and would require additives to remove. Again, we have a fiber compatibility problem. We may see some shrinkage with fibers such as wool and rayon, and some dyes are water soluble. In the past, the garment manufacturers have selected care labels for laundering instructions or dry cleaning instructions based upon those compatibility problems with fibers and dyes. As we began to look at using wet cleaning as an alternative to dry cleaning, we find compatibility problems that require careful attention. Our objective, in part, is to evaluate the cleaning technology. We looked at this from a consumer's perspective in terms of what does the consumer expect from taking something in to have it cleaned. Getting the garment back clean without damage is a prime consideration. And, indeed, our protocol would be to look at the ability to clean as well as the consequences to different kinds of fabric.

Performance Criteria

For each technology, we want to identify problem soils. We already know part of our results for wet cleaning—problem soils are those containing an oily component. For solvent cleaning, it would be those containing a water-soluble component. We also want to identify for each technology what fabrics create problems. We have some indications in terms of what can be possible for care labels. We also, at some point, (and this is not currently funded under the project) need to evaluate variables brought about from the manufacturers in terms of how the garments are constructed. We've already found some anecdotal cases in terms of how fabrics that are fused respond differently to the different cleaning technologies.

To evaluate cleaning performance, our plan is to look at some of the standard cleaning assessments swatches available from the International Fabricare Institute and European laboratories. The objective is to adequately represent what a consumer might expect in terms of soil removal from a garment. We also are going to be selecting fabrics to evaluate. The ones that we feel are fairly obvious to look at are those that would be difficult to launder, or those that would normally be sold at this time with a "dry clean only" label: wools, silks, rayons, and some acetates. The project is not designed to look at the whole laundering issue in terms of evaluating launderable fibers like cotton and polyester, but to look at the fibers that would be difficult if we had to suddenly eliminate solvent cleaning. The objective for each of these technologies is to identify problem areas and limitations, specifically with regard to what soils they can handle and what fabrics can be safely processed. This research would provide the American Association of Textile Chemists and Colorists and the American Society for Testing and Materials with information that would have an impact on revisions of care labels, so that the care label coming to a cleaner would give them proper instructions as to what they can and cannot do with a garment. One of the keys is to provide a technology or a protocol by which we could look at cleaning technologies and make a comparison of how the technologies perform in terms of soil limitations and fabric limitations. Being optimistic, what kind of objectives might we then follow up with when this project is finished? The objective would be certainly to continue this kind of dialogue with this kind of group and continue to establish better communications between the cleaning industries and the apparel manufacturers. We wish also to acknowledge that we plan to learn from our colleagues in Europe. I see no reason for us to spend money to evaluate technology that they've already looked at, so we're looking forward to an ongoing dialogue with European and other international organizations in terms of this technology.

1

Texas Research Center History

- Established in 1983 to provide a facility for research and training in laundering and drycleaning
- Donation of equipment by manufacturers coordinated by the Texas Laundry and Drycleaning Association (TLDA)

2

Texas Research Center Industry Partners

- SDA (Southwest Drycleaning Association) previously TLDA (Texas Laundry and Drycleaning Association)
- TRSA (Textile Rental Services Association of America)
- UTSA (Uniform and Textile Services Association of America)

3

Texas Research Center Related Programs

- Drycleaning and laundering courses—sponsored by SDA
- Production Management Institute—cosponsored by TRSA and UTSA
- Maintenance Management Institute—cosponsored by UTSA and TRSA
- Research—sponsored by Texas Food and Fibers Commission (TFFC) and EPA

4

Testing and Development of Pollution Prevention Alternatives to Reduce Indoor Air Emissions from Perchloroethylene Dry Cleaning and Dry Cleaned Fabrics

5

North Carolina State University College of Textiles

&

Texas Woman's University

Texas Research Center for Laundry and Drycleaning

6

- NCSU—Identify and Screen New Technology
- TWU—Evaluate Currently Available Technology
- Both—Develop Universally Accepted Procedures to Evaluate Cleaning Technology

7

Current Cleaning Technology

- Solvent Cleaning Using Perchloroethylene is Most Common Method
- Solvent Cleaning Using Hydrocarbons
- Wet Cleaning—Machine and Manual

8

Plant Scale Equipment

Texas Research for Laundry and Drycleaning

Project Contributors:

UniMac Company—	Wet Cleaning Machine, Model UA230, with Seitz Chemicals
	ADC Dryer Model UD80 with Microcomputer
	$10,000 for supplies
AquaTex—	Drying Cabinet
Böwe Passat—	P546 46 lb, Perchloroethylene Drycleaning Machine
Exxon—	DF2000 Hydrocarbon Solvent
Pending—	Liquid Carbon Dioxide Cleaning Machine

9

Solvent Cleaning

- Solvents are filtered, distilled, reused at the cleaning plant
- Most effective on oily type soils—require additives to remove water soluble soils
- Some fibers are sensitive to solvents
- Some dyes and finishes are removed by solvents

10

Solvent Cleaning

- Perchloroethylene—nonflammable—health and environmental concerns
- Hydrocarbons—flammable—may be health and environmental concerns

11

Wet Cleaning

- Not laundering
- Water discharged to sewer
- Most effective on water soluble soils—additives required to remove oily type soils
- May cause shrinkage of wool, rayon
- Some dyes are water soluble

12

Evaluating Cleaning Technology

- Ability to Clean
- Minimum Damage to Garment

13

Performance Criteria

- Soil Removal—Identify Problem Soils
- Fabric Damage—Identify Problem Fabrics
- Variables in Garment Construction

14

Soil Removal Standards

- IFI Cleaning Performance Test
- Krefeld Standard Soils
- TNO Standard Soil
- Others

15

Fabric Selection

- Wool—Lightweight, Worsted, Woven
- Wool—Heavyweight, Woolen, Woven
- Wool—Medium Weight, Woolen, Knit
- Silk—Lightweight, Woven
- Rayon—Lightweight, Woven
- Acetate—Lightweight, Woven

16

Final Report

- Identify problem areas and limitations of each technology
- Provide input through AATCC and ASTM to update care labels
- To provide a universally accepted method of evaluating cleaning technologies

17

Future Objectives

- Establish better communications between cleaning industries and apparel manufacturers
- Form cooperative linkages with international cleaning associations